GEOLOGIC MAPPING OF THE Ac-H-9 OCCATOR QUADRANGLE OF CERES FROM NASA'S DAWN MISSION.

D.L. Buczkowski[1], D.A. Williams[2], J.E.C. Scully[3], S.C. Mest[4], D.A. Crown[4], R.A. Yingst[4], P.M. Schenk[5], R. Jaumann[6], T. Roatsch[6], F. Preusker[6], T. Platz[7], A. Nathues[7], M. Hoffmann[7], M. Schaefer[7], S. Marchi[8], M.C. De Sanctis[9], C.A. Raymond[3], C.T. Russell[10].
[1]JHU-APL, Laurel, Maryland, USA; [2]School of Earth & Space Exploration, Arizona State University, Tempe, Arizona, USA; [3]NASA JPL, California Institute of Technology, Pasadena, California, USA; [4]Planetary Science Institute, Tucson, Arizona, USA; [5]LPI, Houston, Texas, USA; [6]DLR, Berlin, Germany; [7]MPI Solar System Research, Göttingen, Germany; [8]Southwest Research Institute, Boulder, Colorado, USA; [9]National Institute of Astrophysics, Rome, Italy; [10]UCLA, Los Angeles, California, USA.

Introduction: NASA's Dawn spacecraft [1] was captured into orbit by the dwarf planet (1) Ceres on March 6, 2015. During the Approach phase capture was preceded and followed by a series of optical navigation and rotation characterization observations by Dawn's Framing Camera (FC) [2], which provided the first images of Ceres' surface.

As was done at Vesta [3], the Dawn Science Team is conducting a geological mapping campaign at Ceres during the nominal mission, including iterative mapping using data obtained during each orbital phase. We are using geological mapping as a method to identify the geologic processes that have modified the surface of dwarf planet Ceres. We here present the geology of the Ac-H-9 Occator quadrangle, located between 22˚S-22˚N and 216-288˚E (Fig. 1).

Data: At the time of this writing geologic mapping was performed on Framing Camera (FC) mosaics from late Approach (1.3 km/px), Survey (415 m/px), and the High Altitude Mapping Orbit (HAMO - 140 m/px) orbits, including clear filter and color images and digital terrain models derived from stereo images. Images from the Low Altitude Mapping Orbit (35 m/px) will be used to refine the mapping.

Key Geologic Features: The Ac-H-9 map area is completely within the topographically high region on Ceres named Erntedank Planum. It is one of two longitudinally distinct regions where ESA Herschel space telescope data suggested a release of water vapor [4]. The quadrangle includes several other notable features, including those discussed below.

Occator is the 92 km diameter crater that hosts the "Bright Spot 5" that was identified in Hubble Space Telescope data [5], which is actually comprised of multiple bright spots on the crater floor. The floor of Occator is cut by linear fractures, while circumferential fractures are found in the ejecta and on the crater walls. The bright spots are noticably associated with the floor fractures, although the brightest spot is associated with a central pit [6]. Multiple lobate flows are observed on the crater floor; these appear to be sourced from the center of the crater. The crater has a scalloped rim that is cut by regional linear structures, displaying a cross-section of one structure in the crater wall. Color data show that the Occator ejecta have multiple colors, generally related to changes in morphology.

Azacca is a 50 km diameter crater that has a central peak and bright spots on its floor and within its ejecta. Like Occator, Azacca has both floor fractures and circumferential fractures in its ejecta and crater walls. Also like Occator, the Azacca ejecta is multi-colored with variable morphology.

Linear structures - including grooves, pit crater chains, fractures and troughs - cross much of the eastern hemisphere of Ceres. Some of these structures appear to be radial to the large basins Urvara and Yalode, and most likely formed due to impact processes (Fig. 1). However, a set of regional linear structures (RLS) do not have any obvious relationship to impact craters and may represent internally driven tectonics [7]. Many of the longer RLS are comprised of smaller structures that have linked together, suggestive of en echelon fractures. Polygonal craters, theorized to form when pervasive subsurface fracturing affects crater formation, are widespread on Ceres, and those proximal to the RLS have straight crater rims aligned with the grooves and troughs [7]. This alignment suggests that the RLS are in fact fracture systems, not ejecta scour or secondary craters. Many of the RLS are crosscut by the linear features radial to Urvara and Yalode, indicating they are not fractures formed due to stresses released during those impact events.

Kirnis is a 115 km diameter crater with a degraded rim deformed by one of RLS pit crater chains. A dome-like feature on the floor of Kirnis might represent uplifting of the Ceres surface.

Conclusions: Future work will include more detailed definition and characterization of surface units. Estimates of their compositional variations will be determined through study of both color images and Visible and Infrared (VIR) spectrometer data. Application of crater statistical techniques will be used to obtain model ages of surface units.

References: [1] Russell, C.T., and Raymond, C.A. (2012) *Space Sci. Rev.*, *163*, 3-23. [2] Sierks, H., et al. (2012) *Space Sci. Rev.*, *163*, 263-328. [3] Yingst et al. (2014) *PSS*, *103*, 2-23. [4] Küppers, M., et al. (2014) *Nature*, *505*, 525-527. [5] Li J.Y. et al. (2006) *Icarus*, *182*, 143-160. [6]Schenk, P. et al. (2015) EPSC2015-527. [7] Buczkowski D.L. et al. (2015) *GSA*, abstract #261709.

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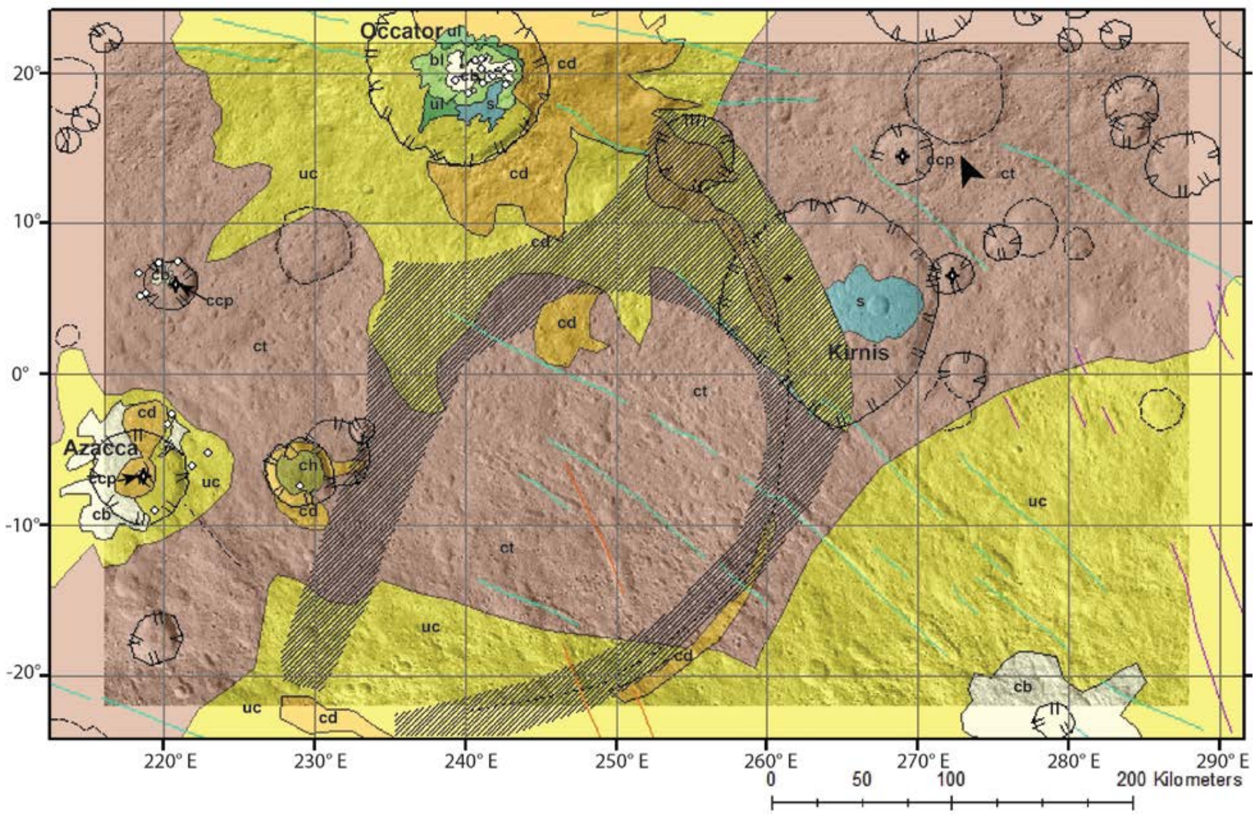

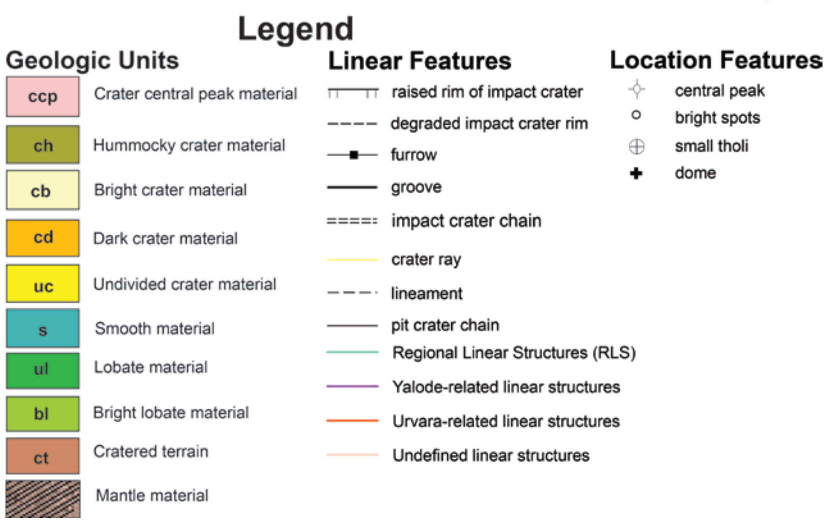

Figure 1. Geologic map of Ac-H-9 Occator quadrangle, based on Survey, Approach and HAMO data.